

Identification of Biological Scatterers and Radar Data Quality Control



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Motive of this study

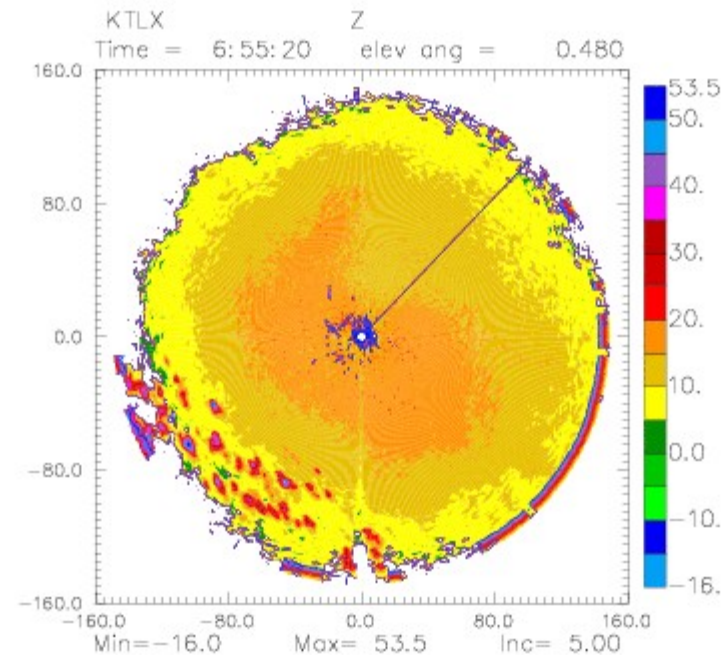


- VAD analysis
- Precipitation estimate
- Aviation safety

Biological Scatterers



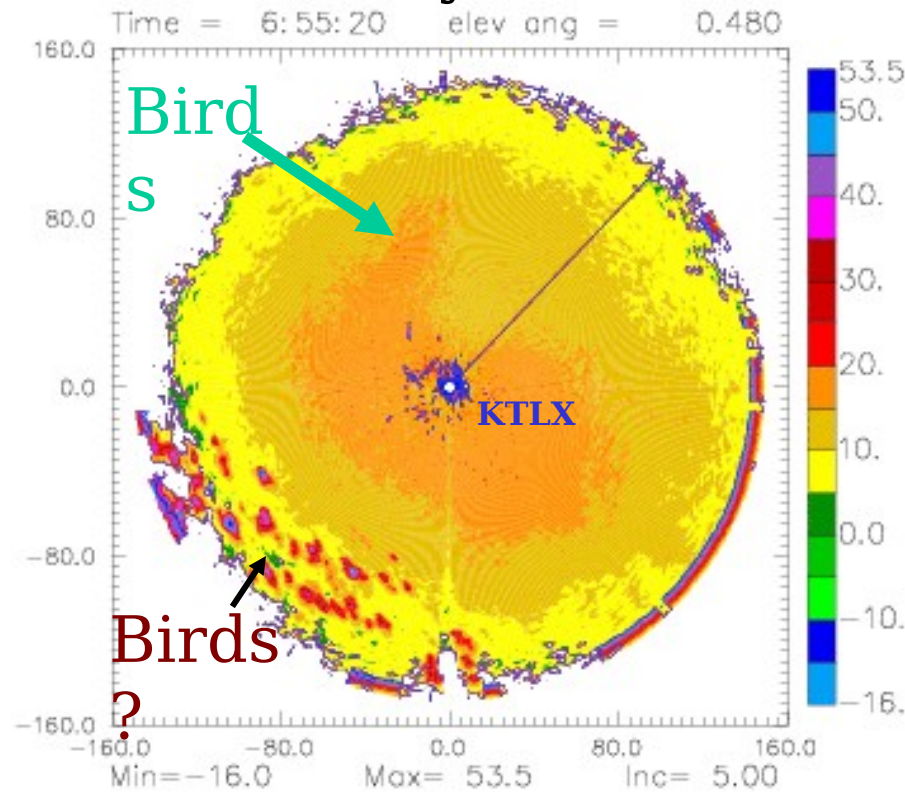
Birds and
insects



Bird Echoes



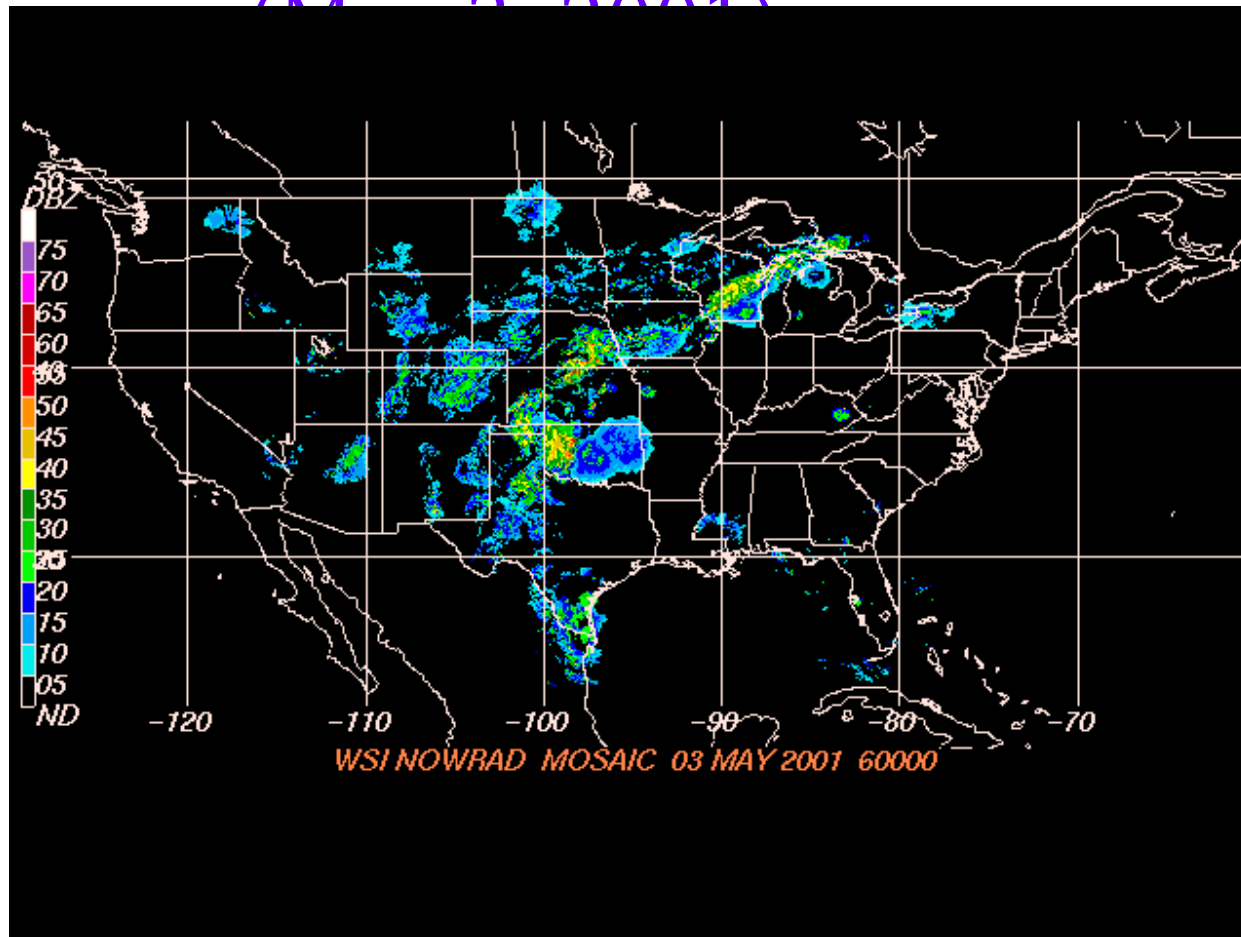
Reflectivity field Elev.=0.5°



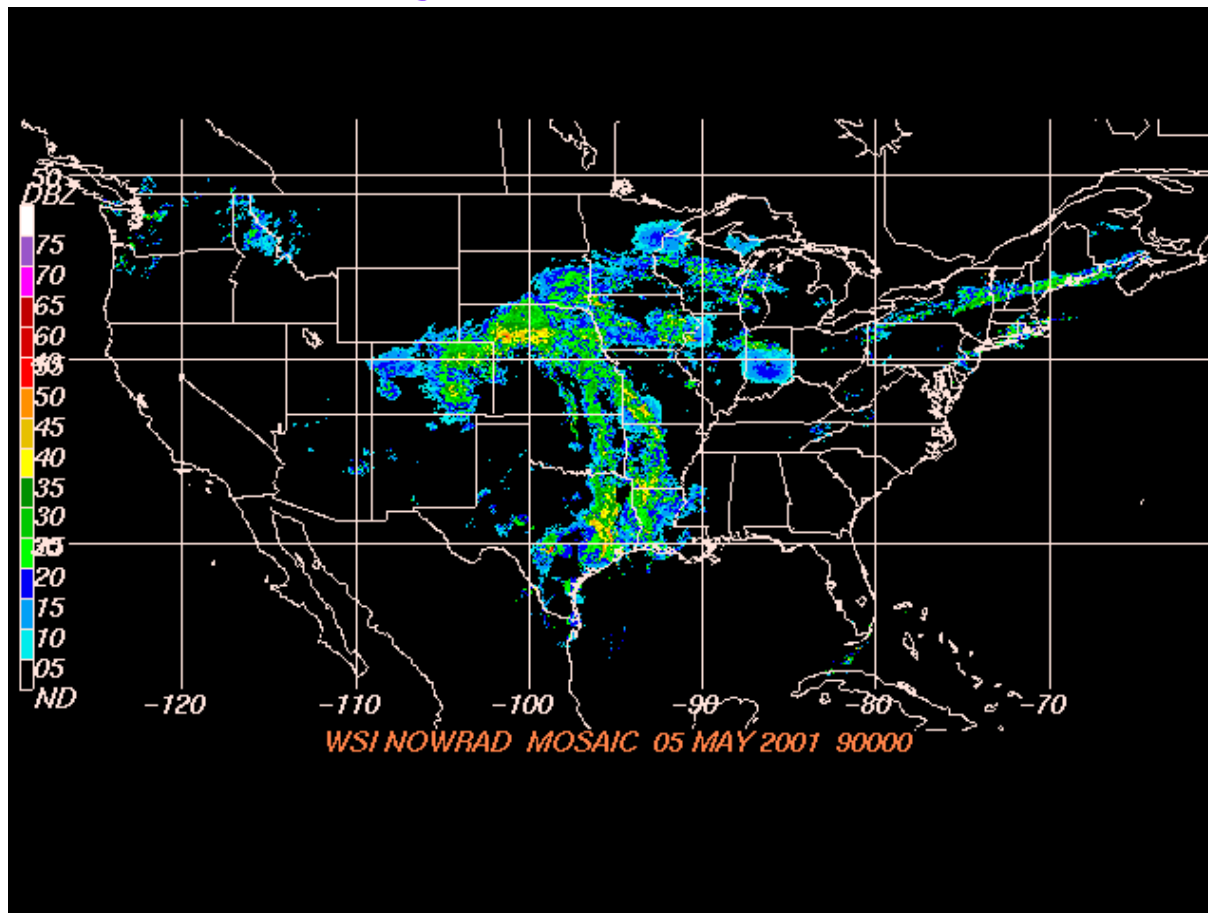
Why?

20010505 06:55:20UTC

Bird echoes on composite Z



Bird echoes on composite Z (May 5, 2001)



Why they are bird echoes

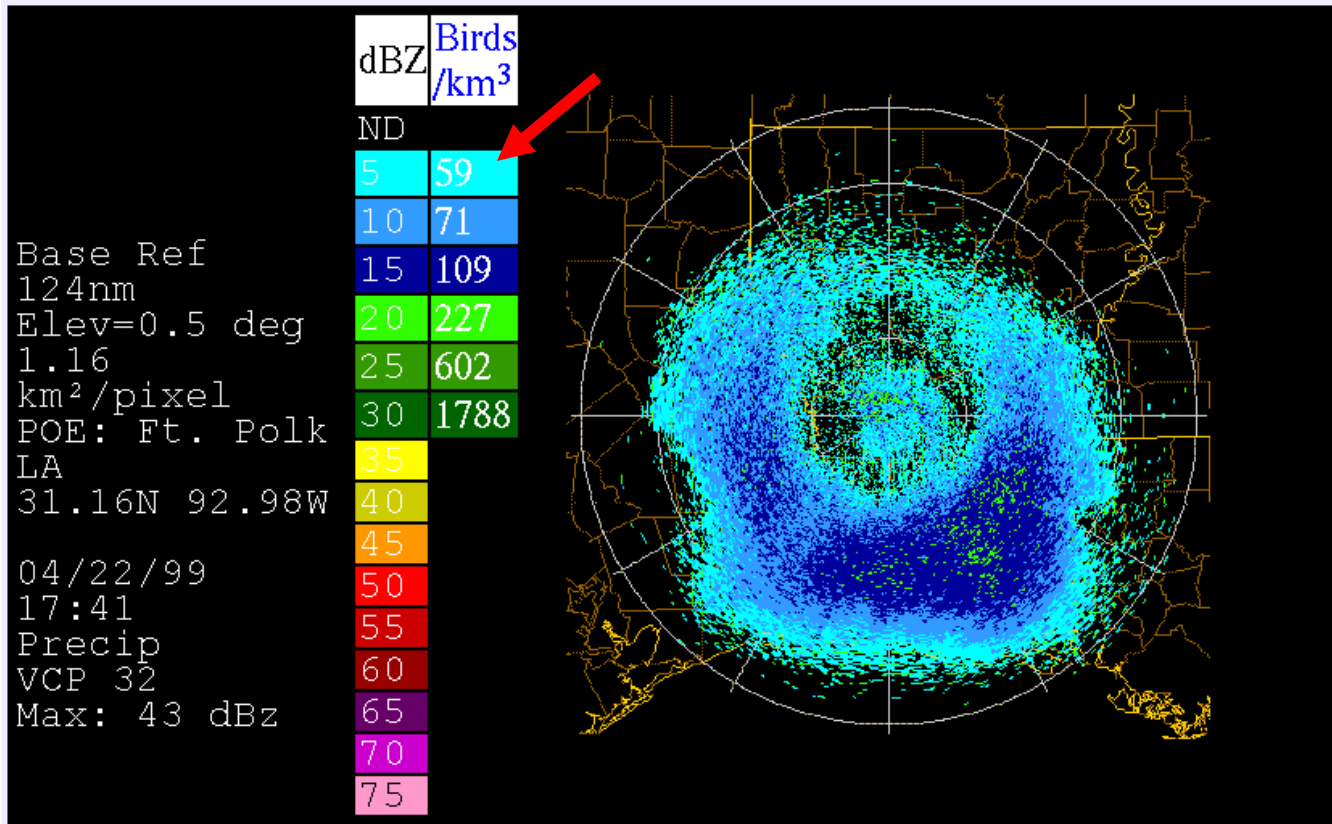


- Previous radar observations and investigations
- Ornithological studies
- Polarimetric radar observations and investigations

Previous radar observations and investigation 1



Precipitation mode base reflectivity image of birds overflying POE Ft. Polk, Louisiana.

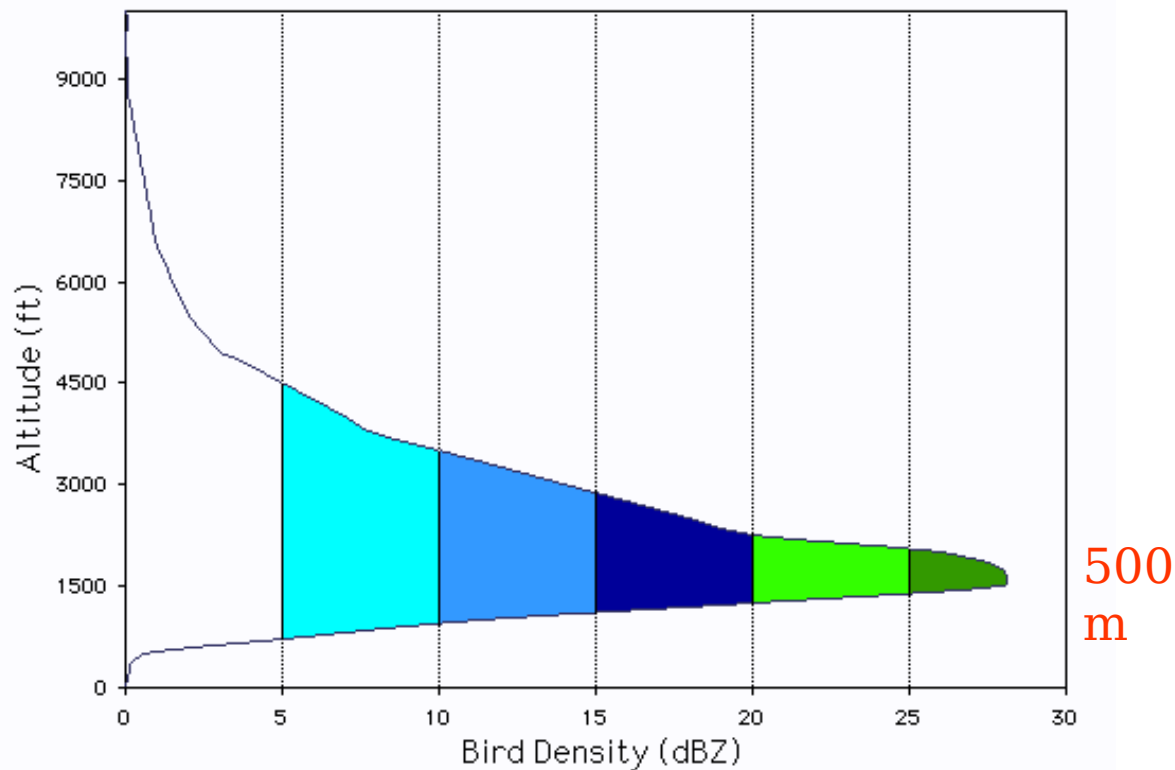


<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 2

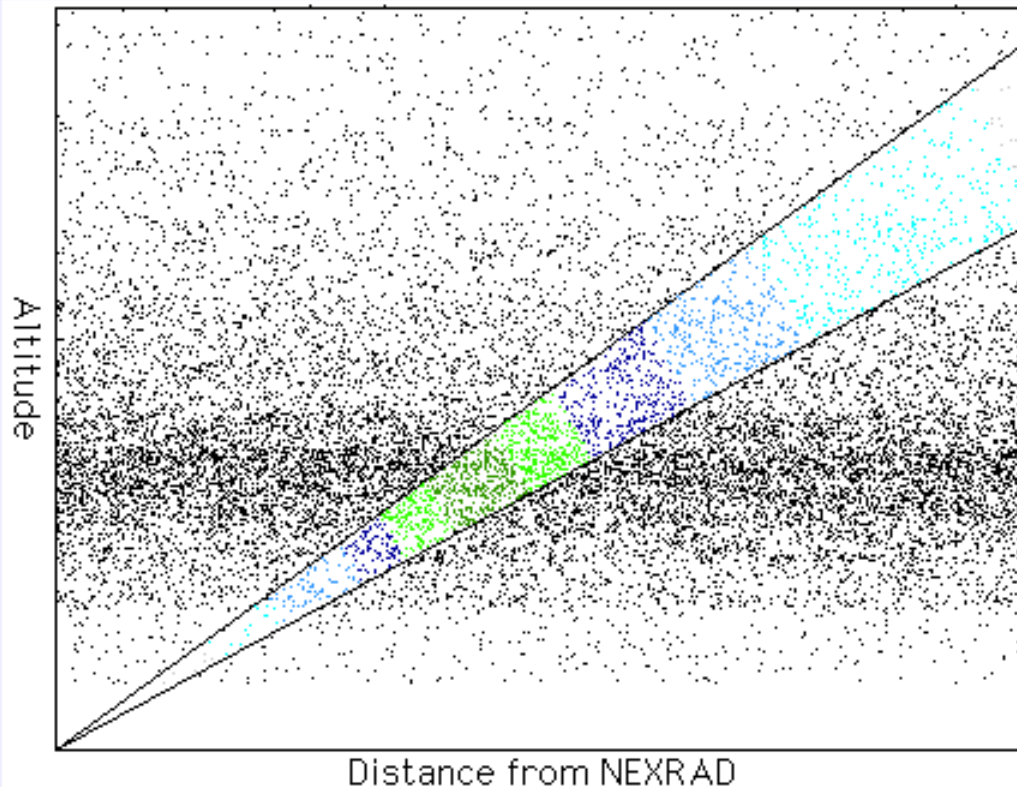


Typical distribution of migrants with altitude



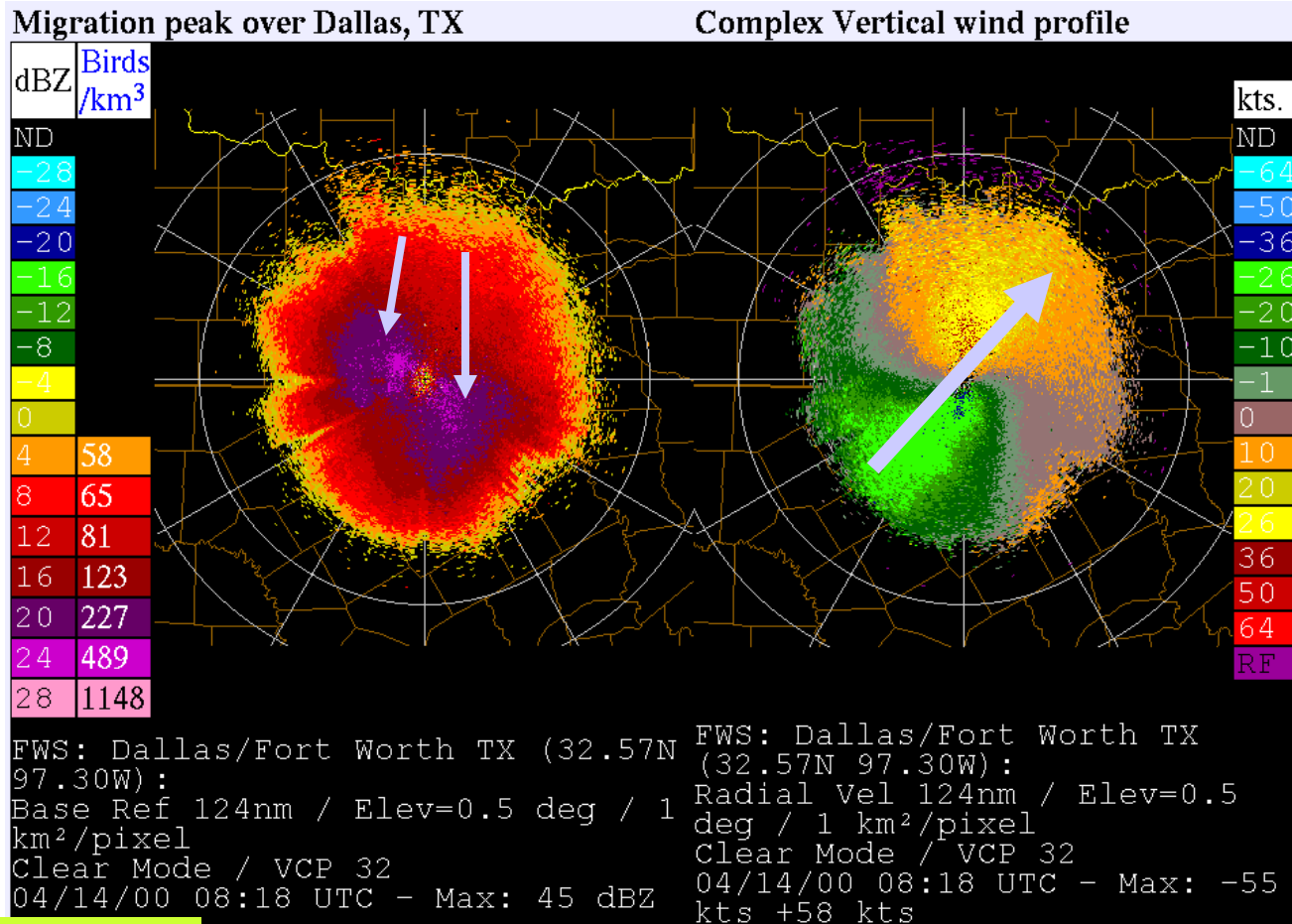
<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 3



<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 4



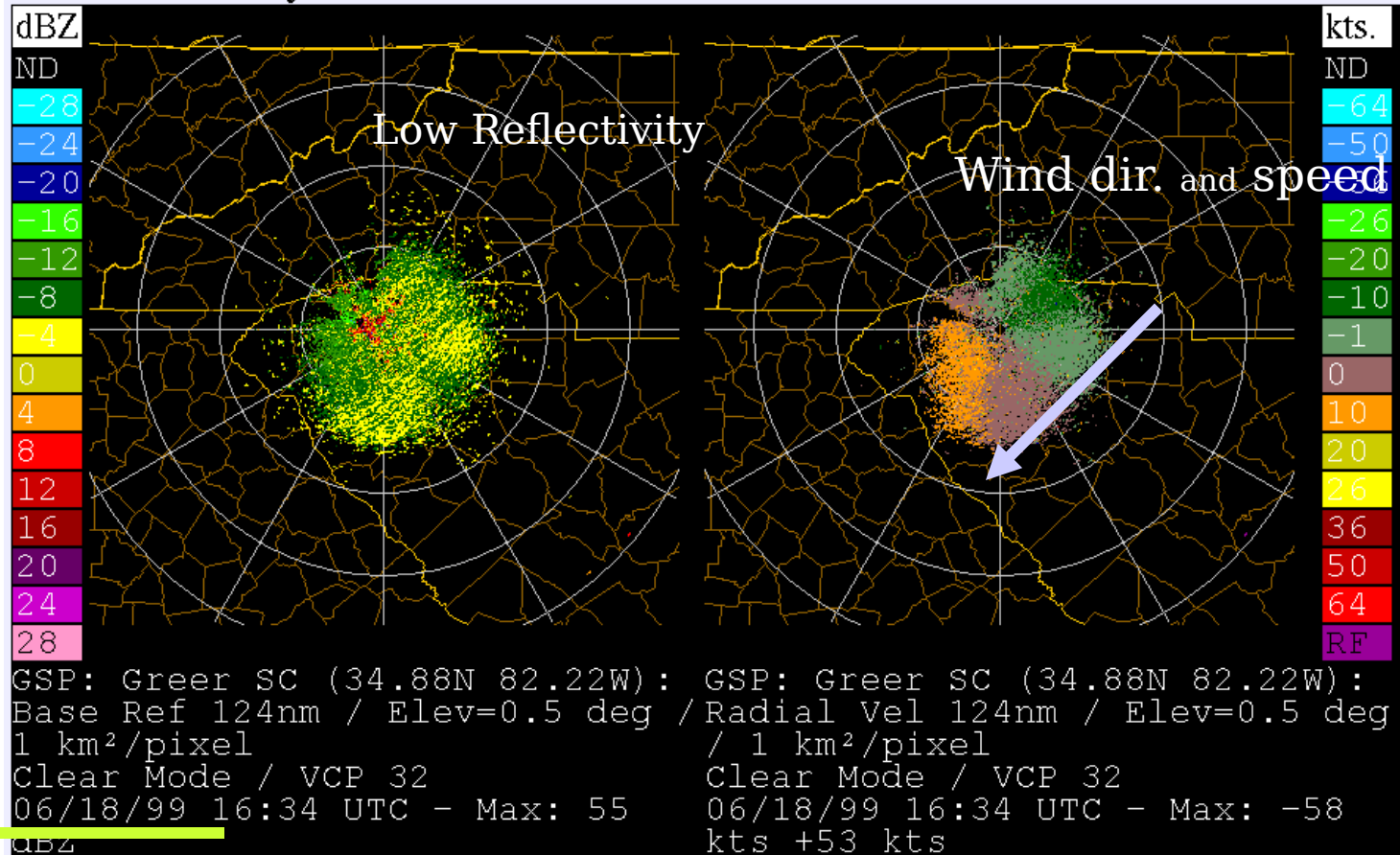
<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 5



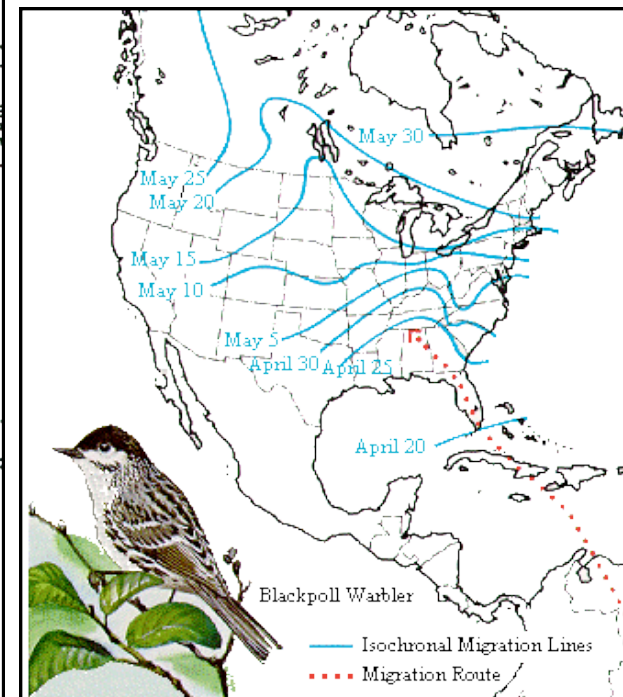
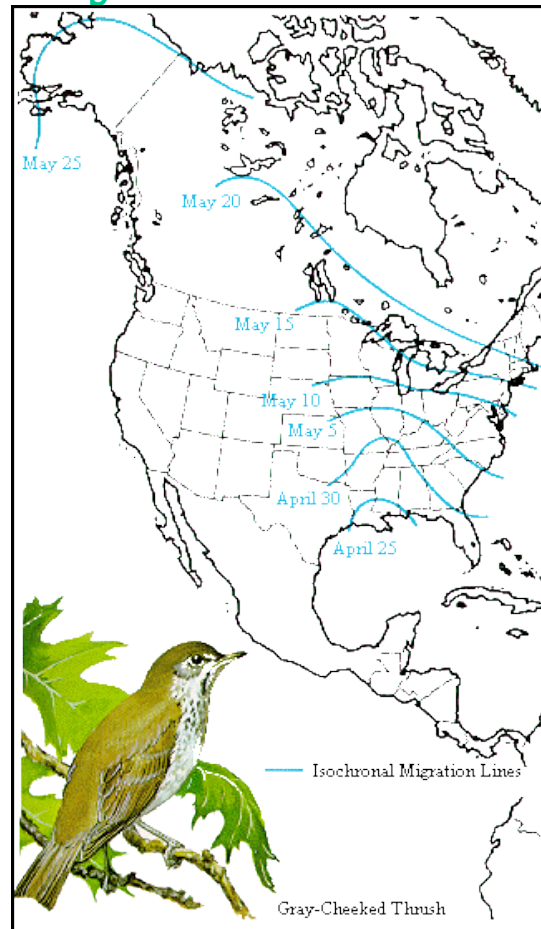
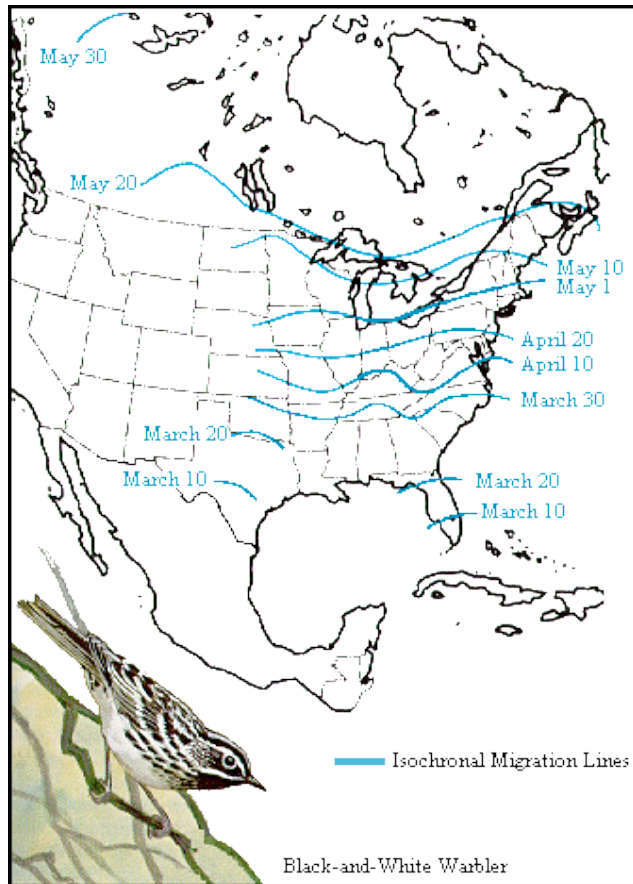
Insects detected by NEXRAD

Insects carried on NE Winds



<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Ornithological studies: Bird migration path and time of year



<http://www.npwrc.usgs.gov/resource/othrdata/migration/migration.htm>

Ornithological studies: Bird migration time of day



What time of day birds migrate?

Night!

Why?

- * avoid their enemies
- * cooler temperature than daylight
- * entire period of daylight to alternate feeding and resting

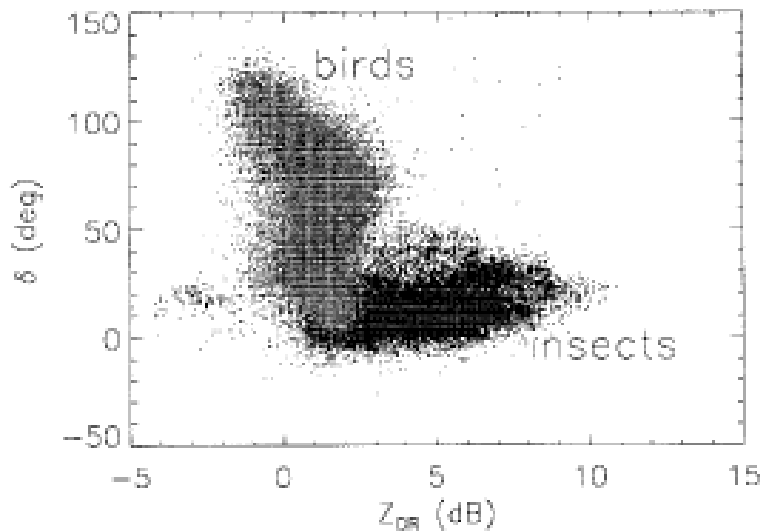
<http://www.npwrc.usgs.gov/resource/othrdata/migration/migration.htm>

Ornithological studies: some facts of migration



- Migrating during the night
- From South to North during the spring
- From North to South during fall
- Bird migrating speed 8-12m/s
- Insect migrating speed 2-6m/s (passive tracer)

Polarimetric radar observations of birds and insects (Zrnic and Ryzhkov, 1998)



Z_{DR} : Differential reflectivity

φ_{DP} : Differential phase

ρ_{hv} : Correlation coefficient

For birds:

Z_{DR} : up to 10dB

φ_{DP} : sometimes over 100°

For insects:

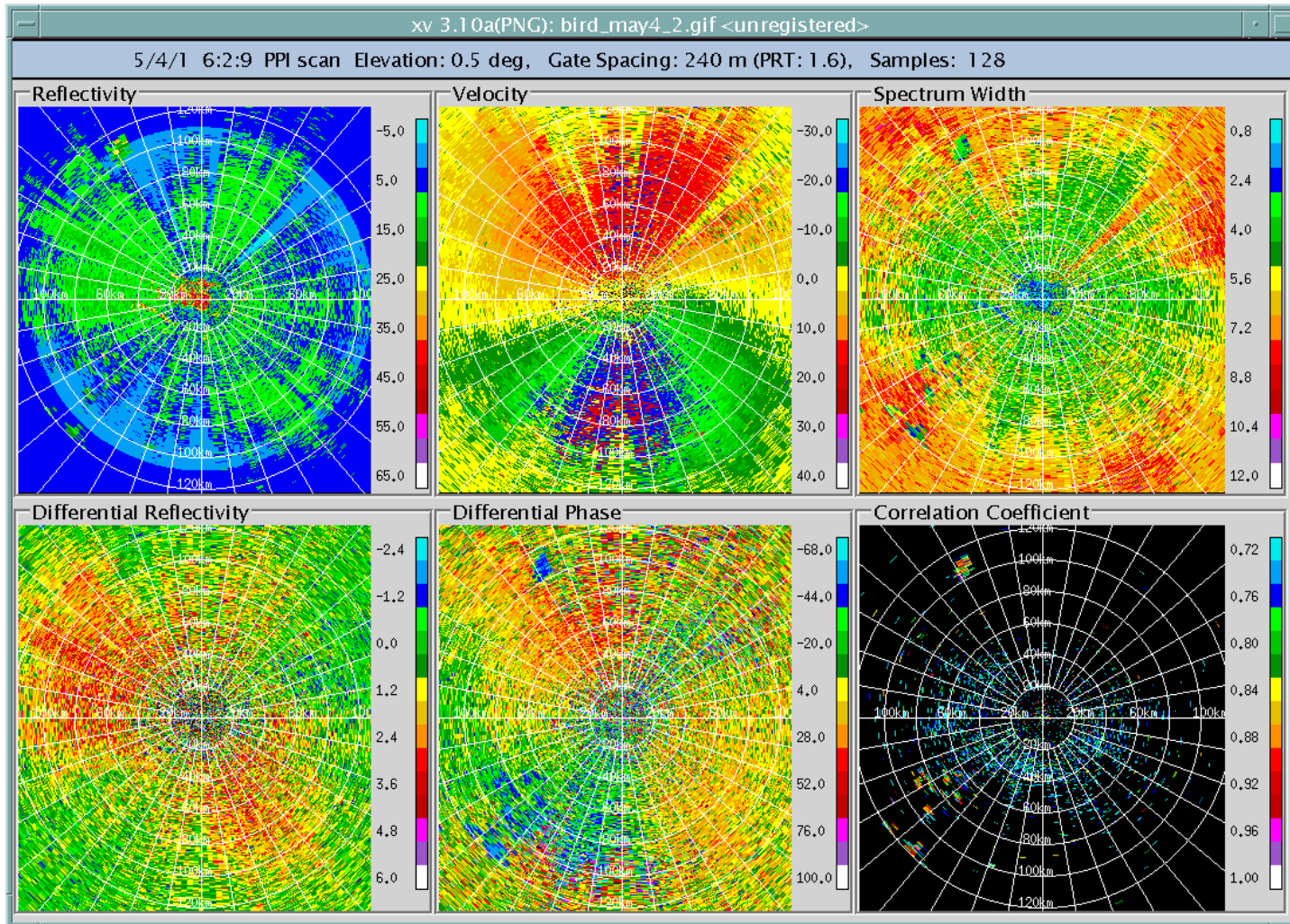
Z_{DR} : between -1 to 3dB

φ_{DP} : less than 40°

ρ_{hv} : 0.95 to 1.0 for weather

ρ_{hv} : less than 0.80 for birds and insects

Porlarimetric radar observations

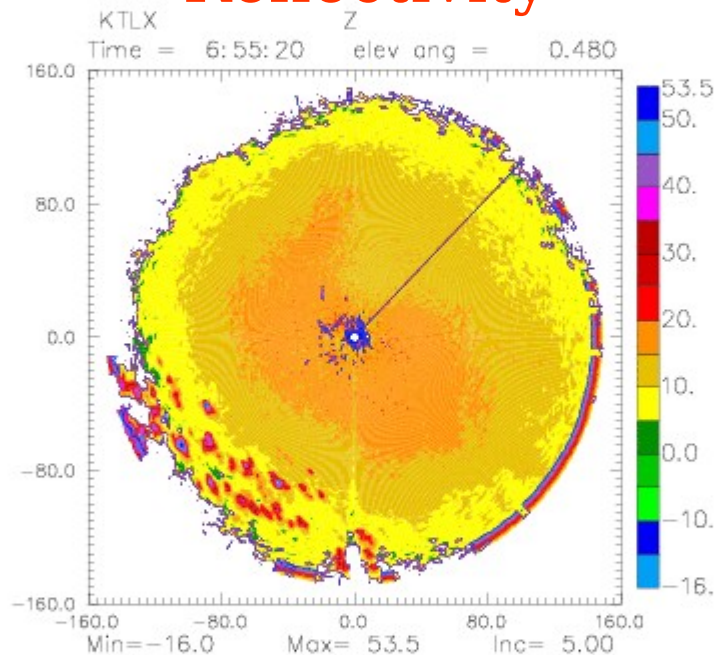


NEXRAD Observations of birds

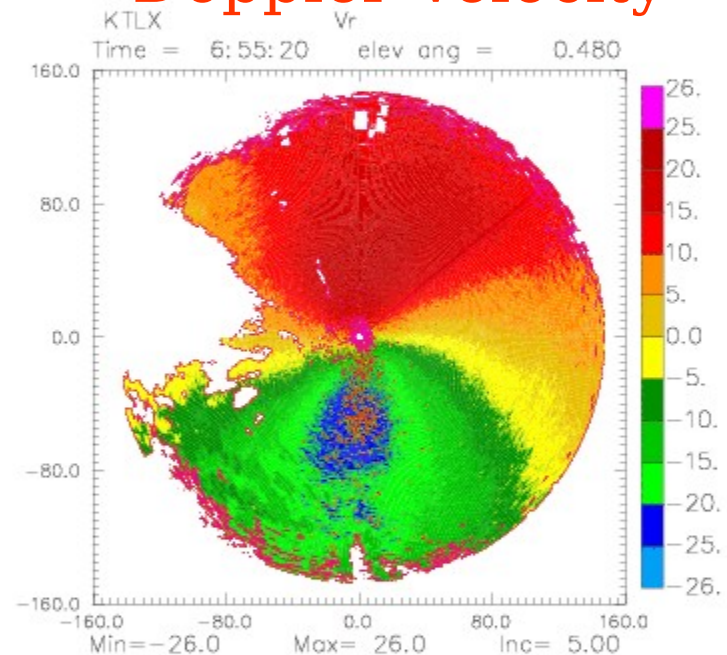
KTLX (06:55 UTC May 4, 2001)



Reflectivity



Doppler Velocity



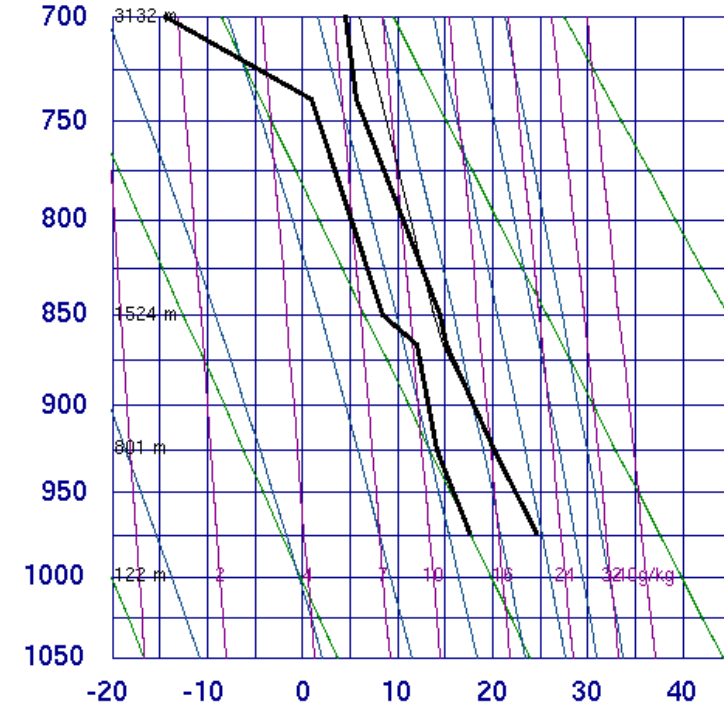
Sounding

00Z and 12Z May 4, 2001 OUN



00Z

72357 OUN Norman

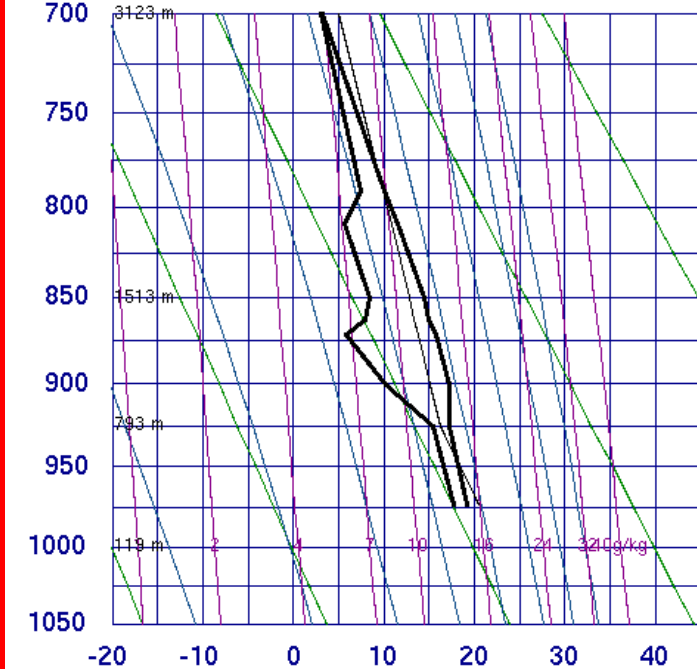


00Z 04 May 2001

University of

12Z

72357 OUN Norman



12Z 04 May 2001

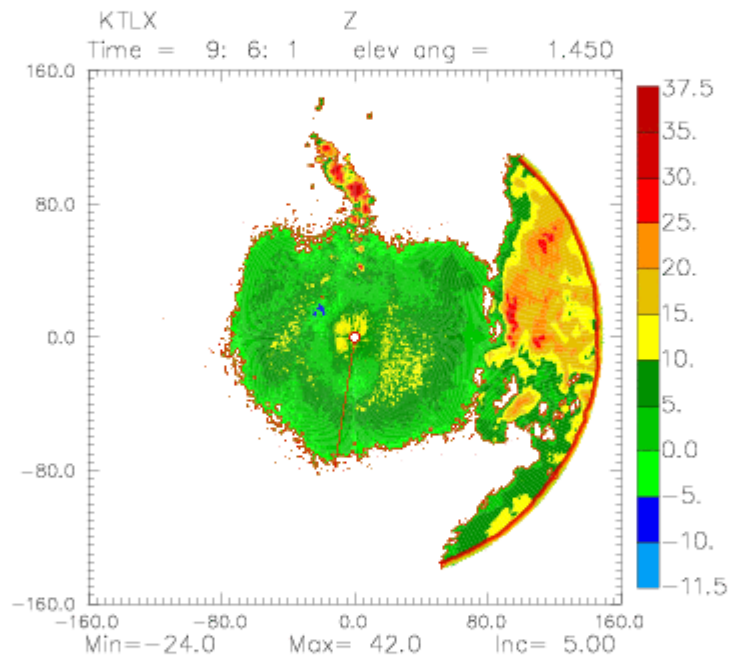
University

NEXRAD Observations of birds

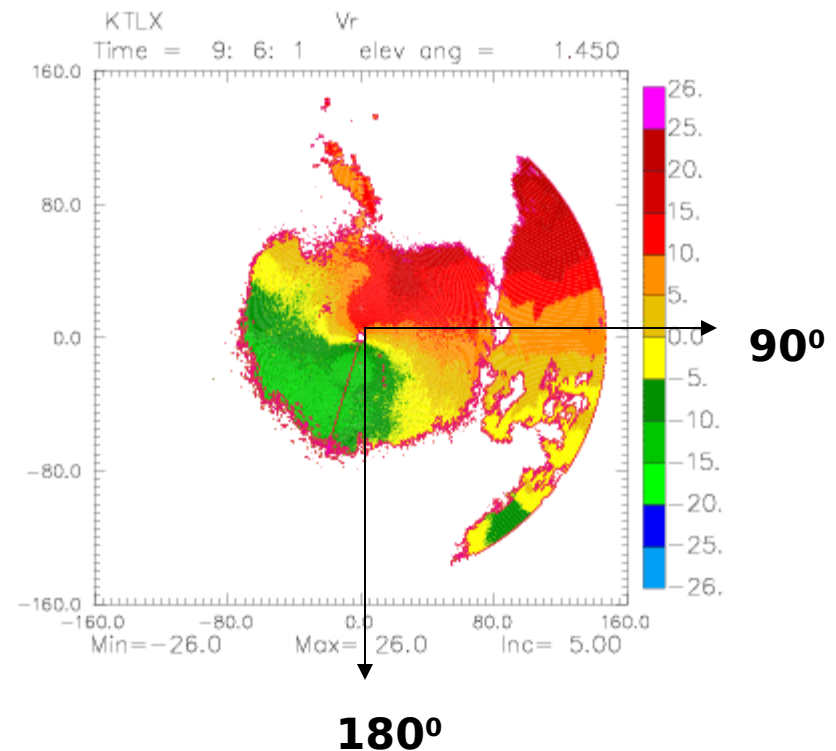
KTLX (09:06 UTC May 5, 2001)



Reflectivity

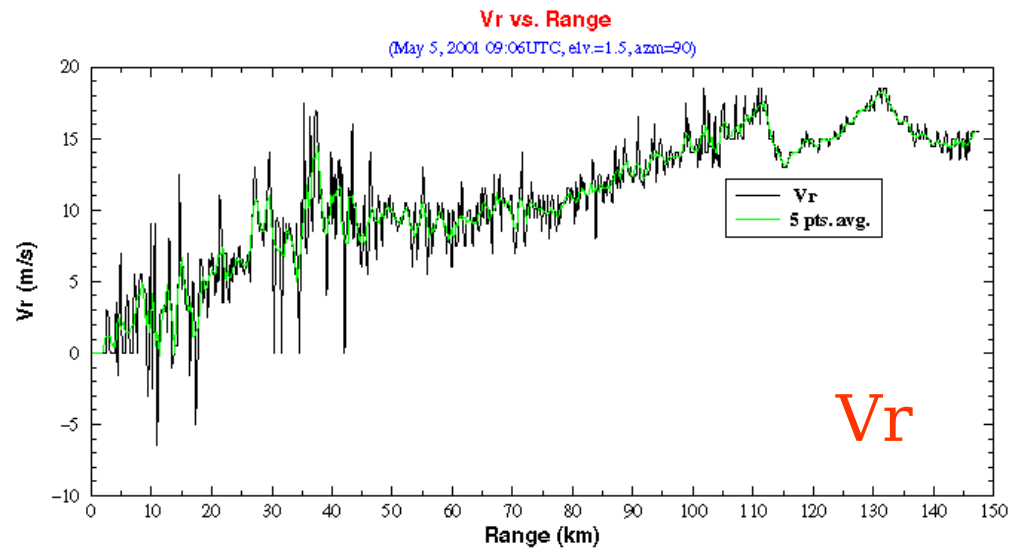
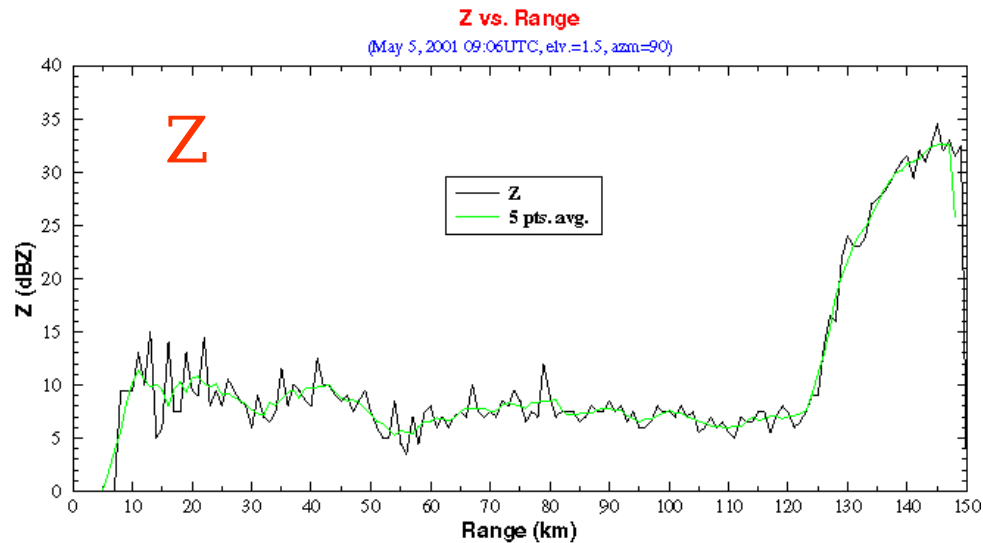


Doppler Velocity



Z and Vr along a beam

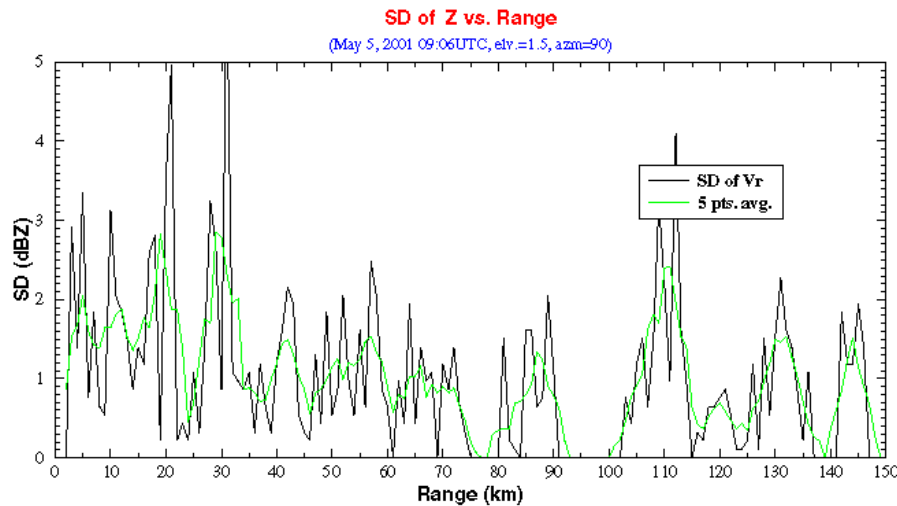
azm = 90°



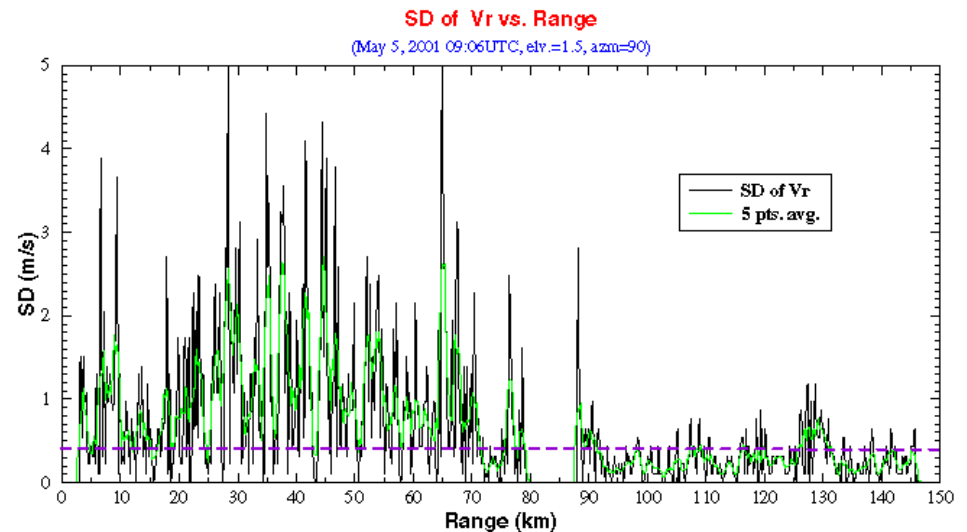
SD of Z and Vr along a beam azm = 90°



SD:
Standard
Deviation



Texture of radar
data



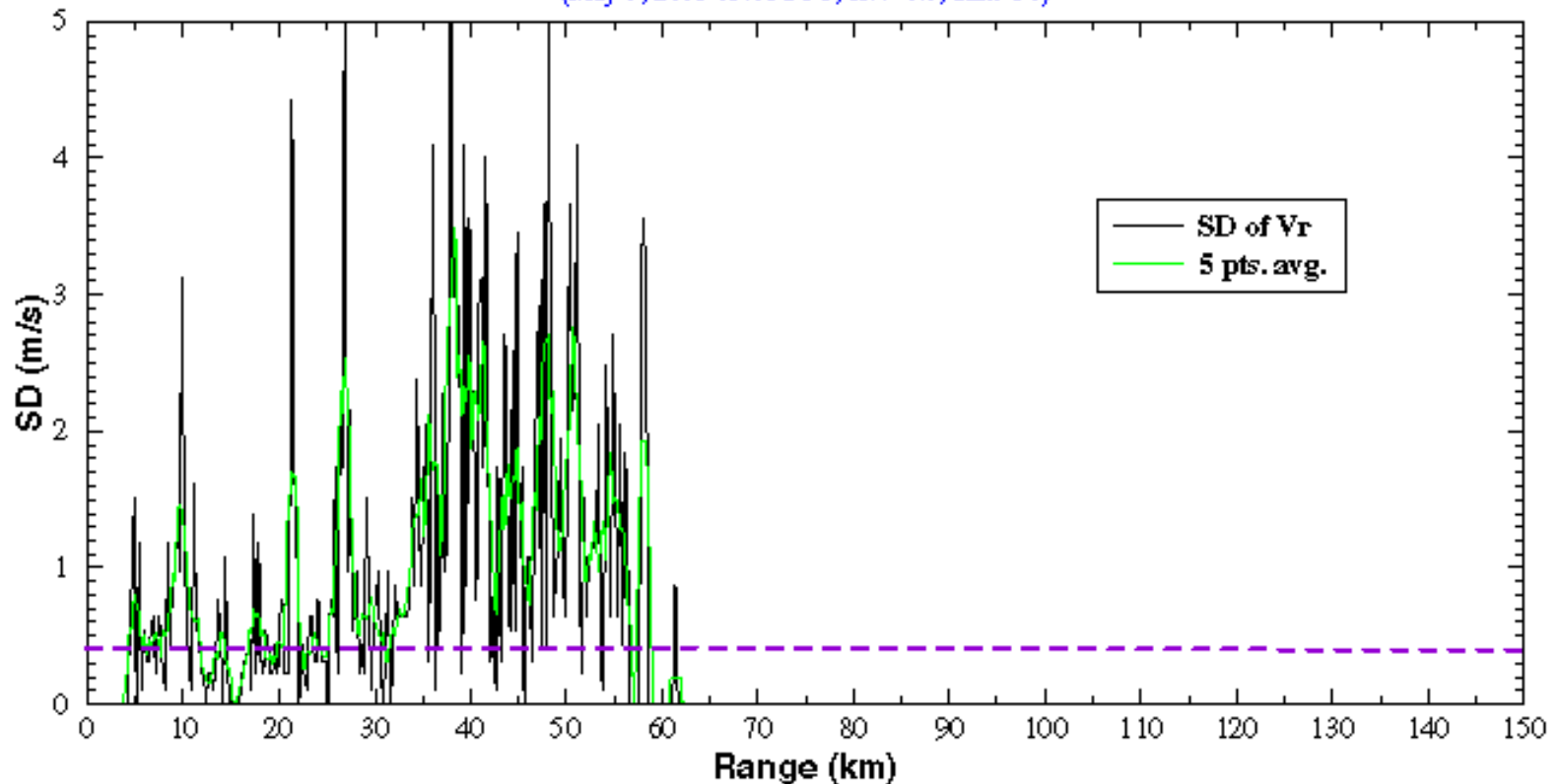
SD of Vr along a beam

azm = 180°



SD of Vr vs. Range

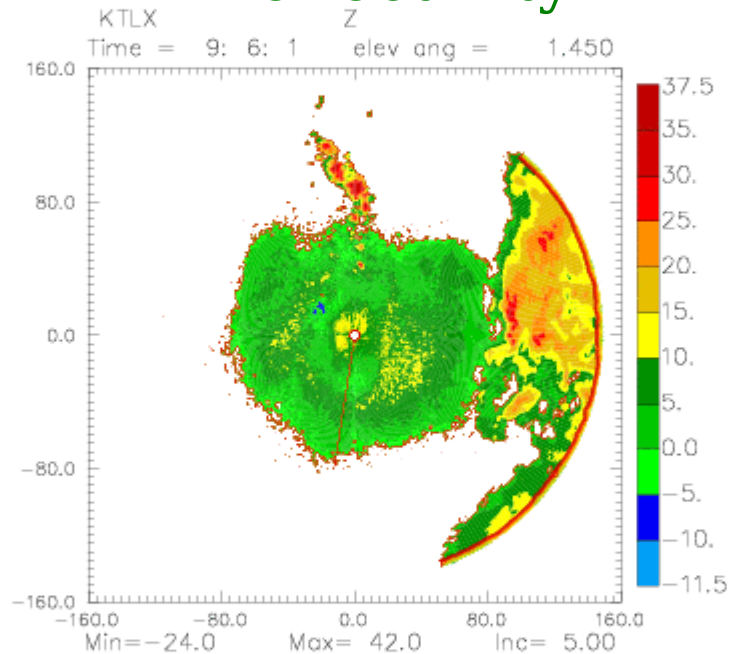
(May 5, 2001 09:06UTC, elv.=0.5, azm=90)



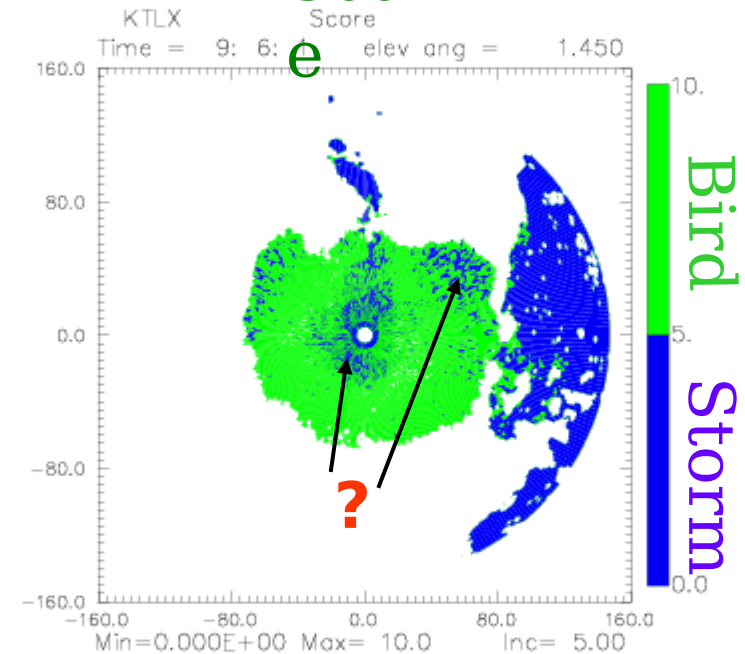
Preliminary Results of Discrimination



Reflectivity



Score





Summary and Future Work

- Automatic discrimination is feasible
- Can be used on other scatterers

More work need to be done:

2D and 3D detection

Ornithological
information, fly speed,
direction, height....